This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (currently amended) A method for optically inspecting a sample having at least one longitudinally extending line, the method comprising:

illuminating the sample with a probe beam;

measuring the diffraction resulting from the interaction of the probe beam and the sample;

defining a model of the sample, the model including a first series of three-dimensional shapes that define a longitudinal edge of a line within the sample;

evaluating the model in three dimensions to predict the diffraction resulting from the interaction of the probe beam and the sample; [[and]]

adjusting and reevaluating the model to minimize the difference between the predicted and measured data <u>to derive information about the roughness of the edge; and</u>

<u>storing the derived roughness information for subsequent use.</u>

2. (original) A method as recited in claim 1, in which the three-dimensional shapes represent mesas on the surface of the sample.

3. (original) A method as recited in claim 2, in which the mesas are shaped as cylindrical or conical projections from the sample surface with the projections having circular or elliptical cross-sections.

4. (original) A method as recited in claim 1, in which the three-dimensional shapes represent holes in the surface of the sample.

5. (original) A method as recited in claim 4, in which the holes are shaped as cylindrical or conical voids in the sample surface with the voids having circular or elliptical cross-sections.

6. (original) A method as recited in claim 1, in which the model includes a second series of three-dimensional shapes that refines the definition of the line edge within the sample.

7. (original) A method as recited in claim 6, in which the first series and second series of three-dimensional shapes differ in shape size, pitch or phase.

8. (currently amended) A method of evaluating the roughness of a line edge on a wafer comprising the steps of:

obtaining optical measurement data from the wafer;

comparing the measured data to calculated data, the calculated data based on a model that includes the scattering effects from an array of holes or mesas and wherein the spacing between the holes or mesas in the models is selected so that the holes or mesas overlap to approximate an undulating edge; [[and]]

adjusting the model to minimize the difference between the calculated and measured data to derive information about the roughness of the edge; and

storing the derived roughness information for subsequent use.

9. (original) A method as recited in claim 8, in which the mesas are shaped as cylindrical or conical projections from the sample surface with the projections having circular or elliptical cross-sections.

10. (original) A method as recited in claim 8, in which the holes are shaped as cylindrical or conical voids in the sample surface with the voids having circular or elliptical cross-sections.

11. (original) A method as recited in claim 8, in which the array of holes or mesas includes a first series of holes or mesas and a second series of holes or mesas in which the first series and second series differ size, pitch or phase of the mesas or holes.

12. (currently amended) A method for optically inspecting a sample having at least one longitudinally extending line, the method comprising:

illuminating the sample with a probe beam;

measuring the diffraction resulting from the interaction of the probe beam and the sample;

defining a model of the sample, the model including at least one line having a width defined to vary over the longitudinal length of the line;

evaluating the model in three dimensions to predict the diffraction resulting from the interaction of the probe beam and the sample; [[and]]

adjusting and reevaluating the model to minimize the difference between the predicted and measured data to derive information about the roughness of the edge; and

storing the derived roughness information for subsequent use.

13. (original) A method as recited in claim 12, in which the line width is defined in terms of one or more periodic functions.

14. (original) A method as recited in claim 13, in which the periodic functions differ in amplitude, frequency or phase.

15. (currently amended) An apparatus for evaluating a wafer having one or more longitudinally extending lines formed on the surface thereof comprising:

a light source for generating a probe beam;

a detector for detecting light from the probe beam diffracted from the wafer and generating measurement signals; and

a processor ~~for comparing~~ which compares the measurement signals to theoretical data, said theoretical data being generated using a model of the sample, said model including a representation of a line having roughness along a longitudinal edge, said representation being based on a series of overlapping three-dimensional geometrical features.

16. (original) An apparatus as recited in claim 15, wherein the measurement signals are compared to a data base of theoretical data generated using a parametized model.

17. (original) An apparatus as recited in claim 15, wherein said processor iteratively adjusts the model so that the differences between the theoretical data and the measurement signals are minimized.

18. (original) An apparatus as recited in claim 15, wherein said light source is broadband and the detection means generates measurement signals as a function of wavelength.

19. (original) An apparatus as recited in claim 18, wherein the apparatus includes a spectrometer.

20. (original) An apparatus as recited in claim 18, wherein the apparatus includes an ellipsometer.

21. (original) An apparatus as recited in claim 15, in which the three-dimensional features represent mesas on the surface of the wafer.

22. (original) An apparatus as recited in claim 21, in which the mesas are shaped as cylindrical or conical projections from the sample surface with the projections having circular or elliptical cross-sections.

23. (original) An apparatus as recited in claim 15, in which the three-dimensional features represent holes in the surface of the sample.

24. (original) An apparatus as recited in claim 21, in which the holes are shaped as cylindrical or conical voids in the sample surface with the voids having circular or elliptical cross-sections.

25. (currently amended) An apparatus for evaluating a wafer having one or more longitudinally extending lines formed on the surface thereof comprising:

a light source for generating a probe beam;

a detector for detecting light from the probe beam diffracted from the wafer and generating measurement signals; and

a processor ~~for comparing~~ which compares the measurement signals to theoretical data, said theoretical data being generated using a model of the sample, said model including a representation of a line having roughness along a longitudinal edge, said representation being based on a line having a width which varies over the length thereof and being defined by a superposition of periodic functions.

26. (currently amended) A method for optically inspecting a sample, the method comprising:

illuminating the sample with a probe beam;

measuring the diffraction resulting from the interaction of the probe beam and the sample;

defining a model of the sample, the model including a first series of three-dimensional shapes that define the edge of a line within the sample and a second series of three-dimensional shapes that refines the definition of the line edge within the sample;

evaluating the model in three dimensions to predict the diffraction resulting from the interaction of the probe beam and the sample; [[and]]

adjusting and reevaluating the model to minimize the difference between the predicted and measured data to derive information about the roughness of the edge; and

storing the derived roughness information for subsequent use.

27. (currently amended) A method for optically inspecting a sample, the method comprising:

illuminating the sample with a probe beam;

measuring the diffraction resulting from the interaction of the probe beam and the sample;

defining a model of the sample, the model including at least one line having a width defined to vary over the length of the line and wherein the line width is defined in terms of one or more periodic functions;

evaluating the model in three dimensions to predict the diffraction resulting from the interaction of the probe beam and the sample; [[and]]

adjusting and reevaluating the model to minimize the difference between the predicted and measured data to derive information about the roughness of the edge; and

storing the derived roughness information for subsequent use.